Original Study

EVALUATION OF THE ABILITY OF SENIOR DENTAL STUDENTS OF QAZVIN FACULTY OF DENTISTRY TO INTERPRET DIAGNOSTIC PERIAPICAL RADIOGRAPHS

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ABSTRACT

Aim: Endodontics is a specialty field in dentistry, in which both the diagnosis and treatment depend on radiographic examinations to a great extent. The aim of the present study was to determine the ability of senior (fifth- and sixth-year) dental students of Qazvin Faculty of Dentistry to interpret diagnostic endodontic periapical radiographs in 2016.

Materials & Method: The current descriptive/cross-sectional study was carried out on all the senior dental students (n=60) of the faculty. First, periapical radiographs depicting different root morphologies and pathologic/endodontic conditions were selected from the archives of Parto Maxillofacial Specialty Clinic. Appropriate radiographs were selected from these radiographs by an endodontist and a radiologist. Then a questionnaire was prepared in terms of the conditions depicted on the radiographs. The students were asked to register their presumptive diagnoses after viewing the radiographs. Data were analyzed with SPSS 21, with the use of frequencies and percentages and chi-squared test.

Results: The results showed that both students groups had a poor knowledge about the diagnosis of the root curvature in posterior teeth; however, they had good knowledge about the diagnosis of the number of roots and roots with open apices. In addition, both groups had a poor knowledge about the interpretation of pathological lesions in relation to the surgical scar of the root, cervical resorption, PDL widening and changes in lamina dura. Overall, the knowledge of the students was at a moderate level and low knowledge level was seen in only 30% of the sixth-year students and in 23.3% of the fifth-year students.

Conclusion: Improving the student's knowledge and further education in relation to weak points in the interpretation of diagnostic radiographs are the best solutions to boost the students' diagnostic abilities.

Key words: *Knowledge, Dental students in Qazvin, Periapical Radiographs, Diagnosis.*

Introduction

Diagnosis and treatment in endodontics depends on radiographic evaluations to a great degree. Periapical radiographs have an important role in the evaluation of periapical status and in the determination of success and failure in root canal therapy.[1,2] Dentists should be educated in the diagnosis of normal anatomic landmarks and their changes and in changes induced by pathological entities that are depicted on radiographs.[2] Success in endodontic treatment depends on some factors, including the diagnosis of the pulp and periapical status, root anatomy, root canal preparation and root canal obturation. Radiography provides the dentists with the most valuable information in association with other diagnostic tests.[2,3] Therefore, radiographic procedures might affect endodontic treatment planning and the quality and cost of oral health care.[4]

Dentists should have a thorough understanding of the internal anatomy of teeth to be able to form a mental image of such relationships before endodontic treatment.

Accurate evaluation of two or three periapical radiographs from different horizontal angles is necessary. These radiographs provide important data on the morphology of the root canal system. Therefore, the most accurate assessment of the root canal system is possible when the dentist uses the data yielded by various radiographic views in association with accurate clinical assessment of the external and internal anatomy of the tooth. It is absolutely important that dentists use all the resources available to identify and treat the entire root canal system.[5]

Sherwood *et al* showed that more than 80% of dentists made mistakes in interpreting extra roots and root curvatures and none of the dentists were able to interpret changes in the widths of the periodontal ligament, lamina dura and root canal diversities (C-shaped root canals).[2]

Paulina *et al* evaluated the ability of dental students in interpreting root radiographs, missing rate on diagnostic radiographs and the accuracy of students in interpretation compared to general dental practitioners. They reported that students were able to interpret anatomic-morphologic characteristics of the root but made mistakes in the interpretation of calcifications and periapical changes.[4]

Azimi *et al* evaluated the ability of last-year dental students in Qazvin University of Medical Sciences to interpret radiographic images of oral lesions in 2011–2012. Based on the results, the mean awareness score of the students was 14.32±2.09 of a total score of 20, with a range of 10.5–18. There was no significant difference in mean knowledge scores between male and female students. Overall, the students evaluated in that study had a proper level of knowledge for the interpretation of radiographic images.[6]

Considering the diagnostic problems of periapical radiographs and very unfavorable outcomes in the subsequent treatment plan, the present study was carried out on senior dental students to consider further educational programs if necessary.

The aim of the present study was to determine the ability of senior dental students in Qazvin Faculty of Dentistry to

interpret endodontic pathologic lesions, including widening of the PDL, radiopaque and radiolucent endodontic lesions, different forms of root resorption, root fractures and root calcifications, on diagnostic periapical radiographs in 2016.

Materials & Method

The subjects in the present descriptive/cross-sectional study were all the fifth- (n=30) and sixth-year (n=30) dental students (a total of 60 students) in Qazvin Faculty of Dentistry. The study was carried out in 2016.

First, 27 periapical radiographs were collected from the archives of Parto Maxillofacial Specialty Clinic that depicted root morphologies, root curvatures, different root numbers in anterior and posterior teeth, different numbers of root canals in anterior and posterior teeth, open apices and different pathologic–endodontic conditions, including widening of the PDL in anterior and posterior teeth, different endodontic periapical lesions, different forms of internal and external root resorption, horizontal root fractures, calcifications and pulp stones. Then an endodontist and a radiologist evaluated the radiographs together and selected 21 radiographs depicting the cases above, with standard image quality and resolution. Subsequently, the data on the radiographs were recorded as the gold standard by the two specialists above together in terms of the interpretation of the anatomic and pathologic conditions and their interpretation. The radiographs were coded and recorded on CDs. A high-quality PowerPoint file was prepared and a questionnaire was prepared in terms of the type of the radiograph.

To confirm the validity of radiographs, two other specialists evaluated them. To confirm the reliability of the radiographs, 6 dental students participated in a test session before the main session and in a test session after the weeks. Cronbach's alpha coefficient was calculated at 0.87.

All the fifth- and sixth-year dental students in Qazvin Faculty of Dentistry (n=60) were asked to view the radiographs on the PowerPoint file on a screen in a dimly-lit room under the same condition. An endodontist provided the necessary explanations and the students registered their presumptive diagnoses for each case on special forms. First, the radiographs depicting different anatomical forms and root and root canal morphologies were presented, followed by radiographs depicting pathologic endodontic lesions along with the necessary explanations.

Data were analyzed with SPSS 21. Data were described with frequencies and percentages in tables and analyzed with chi-squared test.

The students' names were kept confidential and no costs were inflicted on them.

Results

The fifth- and sixth-year dental students in Qazvin Faculty of Dentistry were evaluated in relation to their ability to interpret diagnostic endodontic periapical radiographs. Data were analyzed with SPSS 21. The results are presented as follows.

The highest correct response rate of the sixth-year students for the interpretation of anatomic variations of the root was related to open apices (83.3%), followed by the number of root canals in anterior teeth and the root curvature of anterior teeth (76.7%); the lowest correct response rate was related to the root curvature of posterior teeth (23.3%).

The highest correct response rate of the fifth-year students for the interpretation of anatomic variations of the root was related to open apices (86.7%), followed by the number of roots in premolar teeth (60%) and the number of root canals in anterior teeth (53.3%); the lowest correct response rate was related to the root curvature of posterior teeth (0%) [Table1]

Variable	Number of correct responses	Percentage	Number of correct responses	Percentage
	Sixth-year		Fifth-year	
Number of roots in molars	19	63.3	14	46.7
Number of roots in premolars	14	46.7	18	60
Number of canals in anterior teeth	23	76.7	16	53.3
Number of canals in posterior teeth	17	56.7	9	30
Root curvature in anterior teeth	23	76.7	11	36.7
Root curvature in posterior teeth	7	23.3	0	0
Open apex	25	83.3	26	86.7

Table 1: The relative frequency distributions of the fifth- and sixth-year dental students' responses in the interpretation of different structural variations of the root on diagnostic periapical radiographs

The highest correct response rate of the sixth-year students for the interpretation of pathologic endodontic lesions on diagnostic periapical radiographs was related to internal resorption (96.7%), followed by posterior periapical and periradicular lesions (90%); the lowest correct response rate was related to apicoectomy (134.3%), followed by cervical resorption (23.3%) and widening of PDL in posterior teeth (30%).

The highest correct response rate of the fifth-year student for the interpretation of pathologic endodontic lesions on periapical diagnostic radiographs was related to internal resorption (100%), followed by posterior and anterior periapical lesions (90%); the lowest correct response rate was related to apicoectomy (6.7%), followed by cervical resorption (13.3%), widening of PDL in posterior teeth (16.7%) and widening of PDL in anterior teeth (23.3%). [Table2]

Variable	Number of correct responses	Percentage	Number of correct responses	Percentage
	Sixth-year		Fifth-year	
Widening of PDL in anterior teeth	11	36.7	7	23.3
Widening of PDL in posterior teeth	9	30	5	16.7
Condensing osteitis	26	86.7	23	76.7
Periradicular lesions (lateral)	27	90	26	86.7
Apicoectomy surgical scar	4	13.3	2	6.7
Periapical lesions in anterior teeth	26	86.7	27	90
Periapical lesions in posterior teeth	27	90	27	90
Furcal lesions	22	73.3	20	66.7
Horizontal fracture	24	80	18	60
Internal resorption	29	96.7	30	100
External resorption (apical)	23	76.7	21	70
Cervical resorption	7	23.2	4	13.3
Calcification	20	66.7	27	90
Pulp stone	18	60	22	73.3

Table 2: The relative frequency distributions of the fifth- and sixth-year dental students' responses in the interpretation of pathologic endodontic lesions on diagnostic periapical radiographs.

The highest correct response rate of students for the interpretation of anatomic variations of the root on diagnostic periapical radiographs was related to open apices (85%) and the lowest correct response rate was related to the root curvature of the posterior teeth (11.7%).

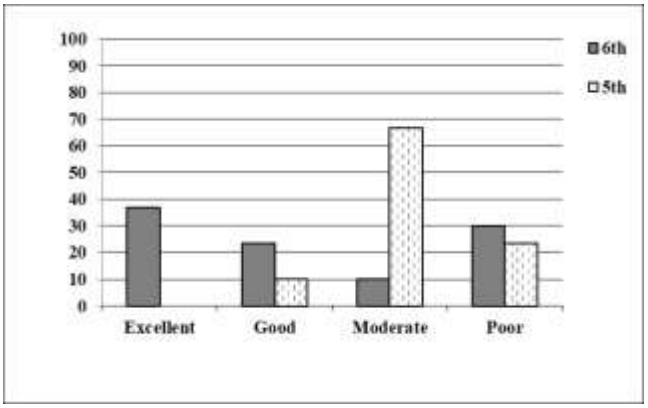
The highest correct response rate of the students in the interpretation of pathologic endodontic lesions on diagnostic periapical radiographs was related to internal resorption (98.3%) and the lowest correct response rate was related to apicoectomy surgical scar (10%).

Chi-squared test revealed a significant difference in knowledge between the fifth- and sixth-year dental students (P=0.000), with a higher level of knowledge in the sixth-year students. [Table 3]

Year / Knowledge	Fifth-year		Sixth-year	
	Number	Percentage	Number	Percentage
Excellent	0	0	11	36.7
Good	3	10	7	23.3
Moderate	20	66.7	3	10
Poor	7	23.3	9	30
	p value = 0.000			

Table 3. Comparison of students' knowledge in relation to interpretation of endodontic diagnostic periapical radiographs in terms of the students' educational level.

As shown by the graph, excellent knowledge level was exhibited only by the six-year students and good knowledge level was observed in a high percentage of sixth-year students; however, the majority of fifth-year students exhibited a moderate level of knowledge. [Graph 1]



Graph 1. Comparison of students' knowledge in relation to interpretation of endodontic diagnostic periapical radiographs in terms of the students' educational level.

Chi-squared test revealed significant differences between the fifth- and sixth-year students in the diagnoses related to the number of root canals in anterior teeth (p=0.03), the number of root canals in the posterior teeth (p=0.004), the root curvature in anterior and posterior teeth (p=0.000), with a higher level of knowledge in the sixth-year students compared to the fifth-year students. However, no significant differences were observed between the two groups of students in the comparison of all the questions on the interpretation of root anatomic variations (P=0.08). [Table 4]

Comparison of the interpretation of pathologic endodontic lesion on diagnostic periapical radiographs between fifth- and sixth-year students in terms of all the questions with chi-squared test revealed no significant differences between the two groups (p>0.05). In addition, comparison of all the questions on the interpretation of pathologic endodontic lesions revealed no significant differences between the three groups of students (p=0.9). [Table 5]

Discussion

The chief aim of the present study was to evaluate the overall knowledge of dental students in Qazvin Faculty of Dentistry to interpret periapical diagnostic radiographs. Given the importance of recognizing the students' weak points in interpretation of radiographs in terms of anatomic landmarks and pathologic entities and by considering the fact that correct diagnosis is important for treatment planning, the present study was undertaken in an attempt to identify these weak points in order to increase students' knowledge.

A total of 21 radiographs were selected, which depicted different variations in root morphology and pathologic

endodontic conditions, and viewed by the dental students for correct diagnosis of the conditions.

The results of the present study showed that the overall knowledge of the students was at a moderate level and poor knowledge was detected in 30% of sixth-year students and in 23.3% of fifth-year students. Very high knowledge level was detected only in sixth-year students and good knowledge level was observed in a great percentage of sixth-year students. Comparison of knowledge between fifth- and sixth-year students showed that sixth-year students were more knowledgeable than the fifth-year students. Root curvature is one of the anatomic variations, which is necessary to identify in order to undertake endodontic treatment and inattention to this important anatomic feature will lead to procedural errors, including transportation, ledge formation and perforation.

Unfortunately, in both groups a small number of students were unable to reach correct diagnoses, especially in posterior teeth; however, it is believed that practice in interpretation of radiographs by students will improve the situation.

The students in both groups exhibited weaknesses in the diagnosis of the number of root canals, especially in roots with more delicate anatomical features. This is also important and great care is necessary at the beginning of endodontic treatment. Inattention to this important consideration will result in missed root canals and treatment failure. It should be emphasized that attention to this important area of diagnosis in the pre-clinic and radiology and endodontic courses will be very useful for students. Comparison of issues related to anatomical variations of the root on diagnostic periapical radiographs between the fifth- and sixth-year dental students revealed significant differences between the students in relation to the number of root canals in anterior teeth, the number of root canals in posterior teeth, and root curvatures of anterior and posterior teeth, with sixth-year students exhibiting a higher level of knowledge compared to fifth-year students. However, there were no significant differences between the two groups of students (p=0.09) in relation to the comparison of all the questions on the interpretation of anatomic variations of the root on diagnostic periapical radiographs, which might be attributed to the small sample size. In addition, these findings might be attributed to the great clinical experience of sixth-year students compared o fifth-year students. Therefore, students' clinical knowledge and practice is absolutely necessary for promotion of diagnostic stills, even in cases involving root anatomic variations on radiographs. It appears the sixth-year students' knowledge about the root and root canal systems was at a favorable level, which is the result of efforts made by the professors during theoretical lessons and practical courses in the phantom clinic and practice in interpretation of radiographs in the department of radiology. In this context, the fifth-year students, too, will be able to acquire such level of knowledge by repetition and continuous practice by the end of their studies. Based on a study by Lanning *et al*, specific educational programs can be used to promote knowledge about interpretation of radiographic images up to 72%.[7] In addition, it has been shown that observing the necessary guidelines and use of proper educational programs can improve skills to interpret radiographic image up to 85%.[8]

In the present study, a large number of students reached a correct diagnosis in relation to radiographs depicting rather specific pathologic lesions, including furcal and periapical radiolucent lesions, condensing osteitis and internal and external resorption; however, cases such as widening of PDL or obliteration of lamina dura, especially in posterior teeth, which require great care and practice, posed diagnostic problems in both groups. This pathologic landmark is the first step in the diagnosis of pathologic endodontic problems.

Kaffe and Graft showed that interpretation without considering the integrity of lamina dura decreased differences between observers, resulting in correct and firm diagnoses.[1] In a study by Sherwood *et al*, too, even practicing dentists were unable to identify changes in lamina dura and PDL status.[2] Similar to the present study, they were able to interpret distinct pathologic lesions but were unable to interpret changes in PDL width and in the status of lamina dura.

In the present study, the students had a problem with the diagnosis of apicoectomy surgical scar as one of the cases, which might be attributed to the fact that students are rarely encountered with such cases. Even after explanations were provided on the radiographs only a very small number of students were able to provide a correct response. Since identification of this entity is one of the most important radiolucent pathologic cases, we decided to evaluate the students' knowledge in this context.

It appears the students had proper knowledge about the diagnosis of distinct pathologic lesions but the problems in relation to more delicate entities should be resolved through attention and more practice with interpretation of different radiographs.

Reinforcement and education in cases in which students exhibited a lower level of ability to reach a diagnosis might be the most important solution to increase diagnostic abilities considering the importance of diagnosis. Therefore, many diagnostic and procedural errors can be avoided by preventing errors in treatment planning.

Conclusion

The results of the present study showed that further education in relation to weakness in the interpretation of diagnostic periapical radiographs is the best technique to promote the diagnostic abilities of dental students.

References

1. Kaffe I, Gratt BM. Variations in the radiographic interpretation of the periapical dental region. J Endod. 1988;14(7):330-335.

2. Sherwood IA. Pre-operative diagnostic radiograph interpretation by general dental practitioners for root canal treatment. Dentomaxillofac Radiol. 2012;41(1):43-54.
3. Carrotte P. Endodontics: Part 2 diagnosis and treatment planning. Br Dent J. 2004;197(5):231-238.
4. Pavlina A. Radiography endodontic interpretation. Int J Sci Res. 2015;4(4):3162-3164.
5. Hargreaves KM, Berman L. Cohen's pathways of the pulp. Elsevier. 2016;11:20,665,675-677.
6. Azimi S, Tofangchiha M, Shapoori M, Rafieian N. Iranian dental students' level of knowledge regarding the interpretation of radiographic images of oral lesions: is the standard training sufficient? J Dentomaxillofac Radiol Pathol Surg. 2016;5(2):1-5.
7. Lanning SK, Best AM, Temple HJ, Richards PS, Carey A, McCauley LK. Accuracy and consistency of radiographic interpretation among clinical instructors using two viewing systems. J Dent Educ. 2006;70(2):149-159.
8. Lanning SK, Best AM, Temple HJ, Richards PS, Carey A, McCauley LK. Accuracy and consistency of radiographic interpretation among clinical instructors in conjunction with a training program. J Dent Educ. 2006;70(5):545-557.

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